ADVANCED TECHNOLOGY PROGRAM

NISTIR 7280

Identifying Technology Flows and Spillovers Through NAICS Coding of ATP Project Participants

John Nail
Hayden Brown

April 2006

NIST National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce

About ATP's Economic Assessment Office

The Advanced Technology Program (ATP) is a partnership between government and private industry to conduct high-risk research to develop enabling technologies that promise significant commercial payoffs and widespread benefits for the economy.

Since the inception of ATP in 1990, ATP's Economic Assessment Office (EAO) has performed rigorous and multifaceted evaluations to assess the impact of the program and estimate the returns to the taxpayer. To evaluate whether the program is meeting its stated objectives, EAO employs statistical analyses and other methodological approaches to measure program effectiveness in terms of:

- Inputs (program funding and staffing necessary to carry out the ATP mission)
- Outputs (research outputs from ATP supported projects)
- Outcomes (innovation in products, processes, and services from ATP supported projects)
- Impacts (long term impacts on U.S. industry, society, and economy)

Key features of ATP's evaluation program include:

- Business Reporting System, a unique online survey of ATP project participants, that gathers regular data on indicators of business progress and future economic impact of ATP projects.
- Special Surveys, including the Survey of Applicants and the Survey of Joint Ventures.
- Status Reports, mini case studies that assess ATP projects on several years after project completion, and rate projects on a scale of zero to four stars to represent a range of project outcomes.
- Benefit-cost analysis studies, which identify and quantify the private, public, and social returns and benefits from ATP projects
- Economic and policy studies that assess the role and impact of the program in the U.S. innovation system

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- Nine out of 10 organizations indicate that ATP funding accelerated their R&D cycle.
- The existence of a "Halo Effect." As revealed by EAO surveys, shows that an ATP award establishes or enhances the expected value in the eyes of potential investors.
- ATP stresses the importance of partnerships and collaborations in its projects. About 85 percent of project participants had collaborated with others in research on their ATP projects.

Contact ATP's Economic Assessment Office for more information:

- On the Internet: www.atp.nist.gov/eao/eao_main.htm
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Abstract

This report describes a methodology used to refine industry classification data used by the Advanced Technology Program's (ATP's) online Business Reporting System (BRS) project database. The primary method for classifying industries is the North American Industry Classification System (NAICS) developed by an Office of Management and Budget interagency working group. The authors assigned six-digit NAICS codes to each ATP project participant's own-industry and the use-industry of any commercial applications reported by project participants, for all projects funded between January 1999 and July 2003. This report documents the authors' methodology used for coding and provides an evaluation to show that ATP projects demonstrate certain factors that suggest high spillover potential; these include multi-use innovation, infrastructural technology, and licensing of technology outside of their own-industry. In addition, a majority of ATP participants' own-industries are characterized as primary technology generators while approximately a third of the use-industries are characterized as either primary or secondary technology generators. This finding suggests that ATP project selection enables technology to be developed in the more sophisticated technology sectors, which may then flow into less sophisticated technology sectors.

This methodology provides ATP a new approach to monitor its technology portfolio. In particular, these data enable one to view the industries that may be affected by commercialization. Eventually, this methodology may lead to a broader effort by the Federal government to track its overall R&D technology portfolio on a more systematic basis. For example, a 2002 report, *Assessing the U.S. R&D Investment*, issued by the Office of Science and Technology Policy, recommends that "OSTP, in cooperation with the appropriate federal agencies, should assess and analyze the adequacy of Federal R&D investments in light of national interests, international competition and human resource needs."

Key words: NAICS, SIC, spillovers, technology flows, technology portfolio, inter-industry diffusion, own-industry, use-industry, R&D, Advanced Technology Program

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Introduction

1

PROJECT OVERVIEW

The Advanced Technology Program (ATP) provides cost-shared funding to private company research and development (R&D) projects that promise significant commercial payoffs and widespread benefits for the nation. ATP project selection focuses on generic technologies developed by upstream producers that enable downstream producers to improve the quality of their products or reduce their costs. To facilitate tracing the flow of ATP-enabled technologies and their spillover benefits, a methodology, documented in this report, was developed to identify each project participant's *own*-industry North American Industry Standard Classification (NAICS) code and the NAICS code of the downstream *use*-industries for each separate proposed commercial application for all ATP projects that started between January 1999 and July 2003.[1] The motivation for this project was twofold. First, NAICS coding enables matching of ATP projects with external data that use NAICS codes (e.g., the economic Census, National Science Foundation R&D expenditure data, and Compustat data). This matching in turn will facilitate research on project impacts and economic outcomes. Second, NAICS coding provides evidence that ATP project selection focuses on projects with high spillover potential.

ATP invests in risky, challenging technologies with the potential to deliver significant national economic benefits. Between 1990 and September 2004, ATP awarded 768 projects involving 1,511 project participants. Of the 768 awards, 550 were led by a single company, and 218 were joint ventures. To date, a total of $4.4 billion of high-risk research has been funded, consisting of $2.27 billion from ATP and $2.1 billion from industry. Small businesses lead 66 percent of all such projects.

This report has two parts. The first part documents the methodology developed to assign NAICS codes to each of the ATP participants and commercial applica-

1. Some commercial applications may be tied to multiple NAICS codes. However, since these data will be used in economic studies, having multiple observations for a single piece of data may prove to be problematic.

tions, using ATP's Business Reporting System (BRS) data.[2] The authors identified the own- and use-industry NAICS codes by cross-checking ATP project descriptions with industry data from Compustat and Hoover's databases and the Internet. After an initial coding of each commercial application, the exercise was repeated to ensure that consistent decisions had been made regarding the assignment of NAICS codes across the various commercial applications.

The second part of this report is an analysis of the ATP project portfolio using a January 1999–July 2003 data sample. The analysis consisted of examining factors, identified by Jaffe (1996), that possess high spillover potential. The findings suggest that ATP selects projects with high spillover potential. In addition, the data were organized into the five different technology areas as defined by ATP. These technology areas include biotechnology, electronics, chemicals and materials, manufacturing, and information technology. The data provide a snapshot of the ATP technology portfolio, as contained in appendix B.

ECONOMIC STUDIES INVOLVING THE TRACE OF TECHNOLOGY FLOWS

ATP selects projects with broad economic impact; therefore, ATP tries to measure how R&D performed by its project participants flows through the U.S. economy. ATP has conducted many standard benefit-cost analyses.[3] These studies examine individual projects on a case-by-case basis. They follow the Mansfield et al. (1977) method of examining innovations at the company level and interviewing company officials and customers about the associated benefits resulting from the innovation. These studies provide precision in measuring the benefits of individual projects. However, they fail to provide a sense of the overall *technology flows* (defined in box 1-1) occurring throughout the entire ATP portfolio. In addition, the cost of conducting in-depth benefit-cost studies makes them impractical to use for each and every ATP project.[4]

Another method, used by economists to study the effects of R&D performed, looks at how technology flows occur from upstream developers to downstream users. Early discussions of technology flows can be found in Brown and Conrad (1967) and Terleckyj (1974). These authors were interested in measuring the impact of R&D,

2. The BRS is a set of survey instruments used to capture data on ATP project participants over the life of the ATP funding and up to six years after funding ends; see section 3 for more information.

3. See the following examples for benefit-cost analysis: Pelsoci (2003), White and Gallaher (2002), and Austin and Macauley (2000). For a literature review of ATP Economic Assessment Office studies through 2000, see Ruegg and Feller (2003).

4. ATP generates status reports on every ATP project. A status report is a mini-case study of the project about three to four years after the completion of the ATP project.

mostly performed by manufacturing industries, on downstream industries that utilized the capital goods in their production process. To identify these technology flows, they used the Input-Output tables produced by the Bureau of Economic Analysis to allocate R&D expenditures from origin to using industries. An Input-Output table lists the expenditures by industry that it uses to make its products. For example, almost one out of three of the inputs in the agricultural sector are manufactured goods. Improvements in those manufactured goods used by the agricultural sector may eventually flow into the agricultural sector, thereby, raising the productivity of that sector. This is the main thrust behind analyzing R&D expenditures using Input-Output tables.

BOX 1-1. A Note on Terminology: Own- and Use-Industries

The literature uses the terms *own-industry* and *use-industry*, as well as *upstream* and *downstream industry*, to convey the path by which goods and services flow through the economy. Typically, economic studies using the Input-Output tables employ the terms *own-* and *use-industry* because the Input-Output tables are not based upon the concept of upstream/downstream but of use and make tables. Other economists use the terms *upstream* and *downstream* especially in the spillover literature. For the purposes of our study, we explicitly use the terms *own-* and *use-industry* to describe our data. However, conceptually, we think of the economy as a circular flow of goods between three types of producers; upstream, midstream, and downstream, which we describe in more detail below.

For the purposes of this analysis, the term *own-industry* is used to refer to each participant's primary industry. *Use-industry* refers to the primary industry in which the commercial application will be employed. The terms *upstream* and *downstream industry* illuminate the structure of ATP own- and use-industries in relation to the overall structure of the U.S. economy.

Instead of using the Input-Output tables, Scherer (1982) looked at patents by companies performing R&D as a proxy for their innovative output. His group analyzed over 15,000 patents produced by the firms that accounted for 74 percent of total U.S. R&D expenditures for the year 1972. They identified the use-industries from each patent and discovered that two out of three possessed one to three use-industries. For the first two-thirds patents where a use-industry was identified, he allocated the R&D expenditures from those origin industries directly to the use-industries. With the remaining third, R&D expenditures were allocated across the use-industries, based upon the percentage that each use-industry consumed of the origin industry's output, as determined by the Input-Output tables. He used these numbers to estimate the

short-run effect of R&D expenditures on using industries. Scherer (2003) revisited the exercise by using the same 1972 data on R&D expenditures, but this time he allocated the R&D expenditures using variations of the Input-Output tables.

The motivation behind both exercises was to determine how R&D performed in the upstream industries might affect productivity in the downstream industries. In general, using both the 1982 and 2003 methods, Scherer found that allocating a portion of upstream R&D expenditures to downstream using industries explained some of the observed downstream productivity increases. It would be possible to perform a Scherer-type analysis on the ATP projects using the NAICS data.[5]

Popkin (2003) used SIC/NAICS codes to develop a method to estimate the potential spillover effects of ATP projects resulting in successful commercialization.[6] Popkin calculated total spillover potential by summing the intra-industry shipments involving the own- and use-industries for ATP project participants. For example, he showed where one ATP project participant's own-industry was printed wiring boards. The ATP participant proposed a commercial application in the communications equipment industry which would be the use-industry. Popkin asked, "What potential impact might improvements in the printed circuit board industry have on the communications equipment industry and vice-versa?"

The logic behind his method is, the more an industry uses an input to make a final product, the greater the impact improvements in that input will have on the final product. In addition, improvements in the use-industry may spillover into the own-industry. In the printed wiring board case, about 9 percent of the inputs that the communications equipment industry uses come from the printed wiring board industry. Also, how much an industry uses, as its own input, would be impacted by improvements within the industry. For example, 20 percent of the printed wiring board's inputs are printed wiring boards. This is known in the literature as the "diagonal" since it is a column that goes across diagonally in a square Input-Output table matrix.

He suggested that improvements in the communications equipment industry (in this case, the use-industry) would result in spillovers within the communication equipment industry. The impact of these spillovers would be related to the amount of communications equipment used by the communications equipment industry (the diagonal) and the amount of communications equipment used by the printed wiring board industry (a.k.a. the amount of use-industry needed to make own-industry).

5. Polenske and Rockler (2004) performed an analysis of the effects of a single project involving the automobile industry and its impact on the U.S. economy including both direct and indirect effects.

6. See Popkin (2003), pp. 3–5, for a review of the economic spillover literature.

The sum of these four measures is the measure for total potential spillovers. Popkin argued that the likelihood of spillover impact was directly related to the sum of the four measures and suggested the methodology be used to analyze all ATP projects.

The research presented in this paper identifies industry codes for all the proposed commercial applications of projects still in progress. We then examine whether ATP selects projects with high spillover potential. Popkin examined already completed ATP projects, identified the commercialized product (if there was one), and classified the own- and use-industry SIC code for the entire project. These data may be used to perform a similar analysis once commercial outcomes are known.

REPORT ORGANIZATION

This section introduces and defines industry classification terminology and provides a brief overview of industry classification in spillover analysis. Section 2 reviews the concept of economic spillovers and how coding facilitates the identification of projects with high spillover potential. Section 3 contains a brief history of ATP efforts to capture SIC and NAICS code data through its data collection system and describes the process of NAICS coding by the authors of this report. Section 4 contains a detailed analysis of the research findings. Section 5 concludes and provides suggestions for further research.

2

Identifying and Measuring Spillovers

The economic analysis of ATP projects includes, as a key component, quantifying the spillover benefits to the users of the technology. To facilitate the identification of spillovers, this report documents a methodology for assigning six-digit NAICS industry codes to the own-industry and use-industry in the BRS. NAICS codes are very detailed, and a BRS survey respondent must navigate thousands of NAICS codes at the six-digit level and several hundred at the three-digit level. Also, differentiating some codes is difficult, and two different respondents could reasonably assign two different NAICS codes for the same application. Jaffe (1996) identified three types of spillovers: knowledge, market, and network, noting that the three interact synergistically to increase their combined effect. These are defined in box 2-1.

Figure 2-1 shows the source of each spillover and provides a schematic of the interaction process. According to this figure, firm 1 invests in R&D, generating new knowledge that it uses to improve its products or lower its production costs. Assuming that the firm successfully commercializes the results, market competition causes the value of some of firm 1's improvements to be captured by its customers in the form of lower prices or higher quality. This effect alone would cause a spillover gap equal to the customer benefit. But the figure shows other effects as well.

The first downward-pointing arrow indicates that knowledge spillovers flow from firm 1's knowledge base to other firms through disembodied outputs such as papers and patents as well as the process of "reverse engineering" another firm's new product.[1] The second downward-pointing arrow indicates that knowledge also passes from firm 1 to other firms through research results embodied in its new commercial products and processes.

The arrow that connects other firms' knowledge with better products/lower costs, acknowledges that some of the firms benefiting from the knowledge spillovers

1. By reverse engineering the new device, a company may be able to figure out how it was designed and made, and can come up with a similar, though non-IP-infringing, product.

BOX 2-1. Economic Spillovers and Technology Flows

- **Economic spillovers** that accrue from R&D activity fall into three categories: Market, Knowledge, and Network, according to Jaffe (1998)
- **Market spillovers** occur when market transactions involving a new product or process result in some of the benefits flowing to market participants in addition to the innovating firm.
- **Knowledge spillovers** occur when knowledge created by one person is used by another person without compensation, or with compensation less than the value of that knowledge.
- **Network spillovers** occur when the commercial or economic value of a new technology is strongly dependent on the development of a set of related technologies. When developing complex new technologies, there are often several parts that must be developed simultaneously in order for the technology to function properly.
- **Technology flows** refer to the processes by which technologies are developed in one industry (typically an upstream industry) and then are employed by users in downstream industries.

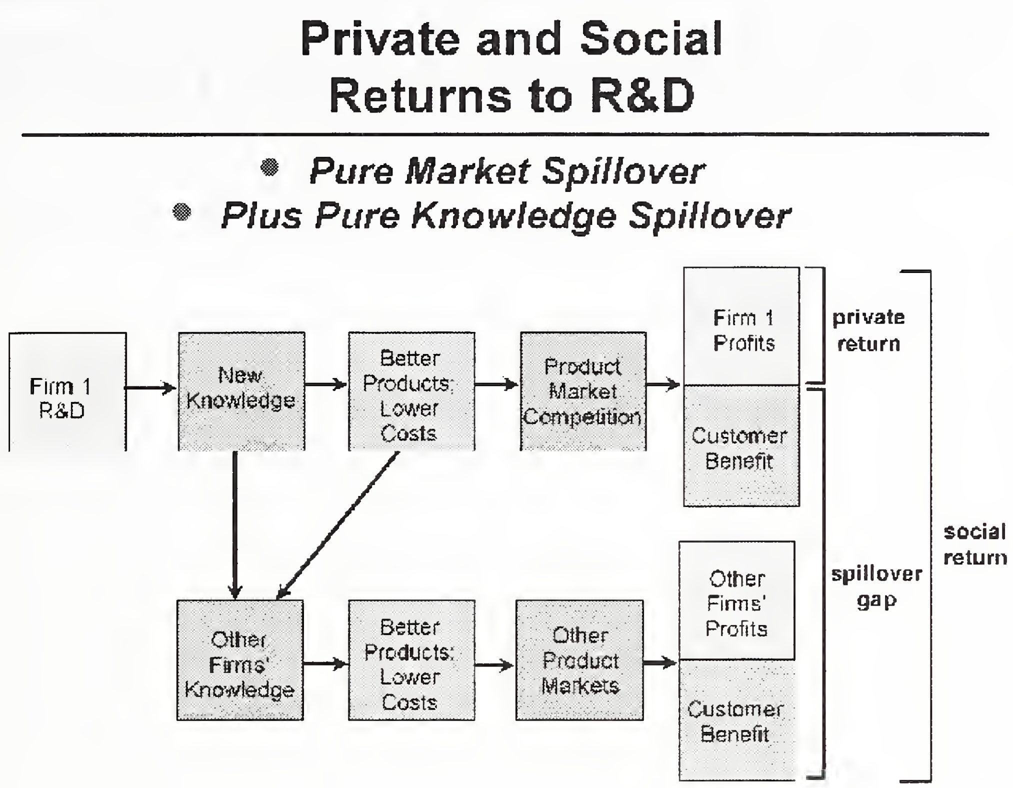
are competitors of firm 1, which then introduce cheaper or better products into firm 1's markets—taking some of its profits and creating some additional customer benefits. Meanwhile, these other firms may also introduce improved or lower-cost products and process into their own markets, resulting in profits for them and benefits for their customers. As Jaffe observes," it is the combination of knowledge spillovers along with competitive interaction which increases the spillover gap both by *raising* the social return and *lowering* the private return" (Jaffe 1996, p. 17).

Jaffe provides a list of factors that affect the potential for market and knowledge spillovers. He also provides a list of factors that increase the likelihood of interacting market and knowledge spillovers, leading to potential network spillovers. Appendix A contains the complete list of factors identified by Jaffe.

This study provides data needed to analyze some of the factors identified by Jaffe as favorable to market and knowledge spillovers. Three of these factors are analyzed using the NAICS codes:

1. **Multi-use innovation, in which many uses are likely to be commercialized by others.** The identification of both market and knowledge spillovers is facilitated by these data since one can identify multi-use technologies in projects where commercial applications cover several different use-industries.

FIGURE 2-1. Private and Social Returns from R&D



Source: Jaffe (1996).

2. **Infrastructural technology (i.e., other researchers are a significant component of the market for the new technology).** A second factor likely to enhance spillovers is whether the technology is infrastructural. The example Jaffe gives is technology that enables other researchers to perform their jobs more efficiently and, therefore, are a significant component of the market for the new technology. These data may be used to identify projects where the use-industry is primarily focused on R&D activities; such projects may be characterized as infrastructural.

3. **Technology in which licensing to others is likely to be important.** An important source of potential market spillovers is projects where licensing occurs across multiple use-industries. For example, companies that commercialize a technology within their own-industry, but license the same technology to companies outside of their own-industry possess the potential for market spillovers.

These are some of the most apparent ways these data may be used to identify factors likely to generate spillovers. Other factors may be measured using these data, but they must be combined with other data such as those collected through the BRS. For example, NAICS codes would not be very helpful in identifying industries that have difficulty protecting their innovations. However, the BRS contains questions that specifically ask how intellectual property is used. The answers to those questions can be properly assigned to project participants' own-industry NAICS code.

There are other areas in which the NAICS coding may help to identify potential spillovers. Ruegg (1999) observed that diffusion of technology *across* industries was much more difficult than *within* their own-industries. Ruegg noted that it was not enough to accept a company's assertions that applications exist. She said that, if the potential is to be realized, there must be knowledge gained about which types of projects work best for cross-industry diffusion and what obstacles exist. NAICS data could be merged with commercial outcomes data in order to determine which projects diffused technology outside of their own-industry.

3

Creation of the NAICS Data Set

DATA SOURCES

The ATP Economic Assessment Office (EAO) uses multiple survey instruments, collectively referred to as the BRS, to capture project participants' business data and commercialization progress; these data help in evaluating the success of ATP projects.[1] Between 1993 and 1998, EAO used a disk-based survey instrument that asked companies to provide the SIC codes applied to their potential commercial applications.[2] Beginning in 1999, EAO switched to a web-based survey instrument and to the collection of NAICS codes. In 1999 and 2000, companies were asked to identify the three-digit NAICS codes for both their own-industry and the industry of their potential business applications. Starting in 2001, EAO reevaluated this request, when it determined that it placed a large reporting burden on the companies but did not yield particularly helpful or consistent data.[3] Box 3-1 defines the SIC and NAICS system of classification. Box 3-2 outlines important attributes of NAICS.

Using this focal information as guidance, EAO assigned six-digit NAICS codes to project participants' own- and use-industries (see box 1-1). Potential spillovers and other associated economic impacts from an ATP project can be more precisely measured using six-digit NAICS codes than the three-digit level. For example, NAICS code 325, which represents all chemical manufacturing, contains 34 separate six-digit industries. By assigning six-digit NAICS codes to own and use-industry, these data will better enable ATP to trace the technology flows that potentially result from ATP projects.

1. For Information on the BRS and the methodology, see Powell (1996).

2. For information on SIC codes for ATP projects between 1993 and 1997, see Powell and Lellock (2000).

3. Instead of NAICS codes, companies were instead asked to classify their technology in terms of National Institute of Standards and Technology's 7 focus and 43 sub-focus areas. These focus and sub-focus areas are different than the five technology categories ATP uses to classify its projects.

BOX 3-1. SIC and NAICS

The **Standard Industrial Classification** (SIC) system is a series of number codes used to classify all business establishments by the types of products or services they make available. Establishments engaged in the same activity, whatever their size or type of ownership, are assigned the same SIC code. These definitions are important for standardization. The SIC codes were developed to facilitate the collection, tabulation, and analysis of data and to promote comparability in statistical analyses.

Beginning in 1997, the SIC system was replaced by the **North American Industry Classification System**. The six-digit NAICS code is a major revision that not only provides for newer industries, but also reorganizes the categories on a production/process-oriented basis. This new, uniform, industry-wide classification system is designated as the index for statistical reporting of all economic activities of the United States, Canada, and Mexico.

BOX 3-2. Key NAICS Attributes

- Common code for the United States, Mexico, and Canada.
- Compatibility with two-digit-level of International SIC (ISIC) codes of the United Nations.
- More industries and more precise distinctions among industries.
- Many new emerging high-tech industries and service industries included.
- Entirely new information industry category.
- New six-digit codes instead of four-digit codes as in the SIC.

These data help reveal how ATP-funded technologies are diffused across multiple industries. One method used to track spillovers created by a technology is to identify the own-industry and the use-industry. The own-industry is the primary industry in which the company operates; the use-industry is that of the potential business application(s) resulting from the new technology. Detailed industry data facilitate research into the pathway by which the benefits developed by a company from its own-industry spill over into the downstream industries of the various business applications. If ATP were to rely on three-digit NAICS codes alone, the spillover potential would be seriously understated.

SIMPLE MODEL OF ECONOMY FLOWS

Figure 3-1 shows a simple model of the economic pathways by which different industries produce goods for each other (inter-industry flows) and then how raw materials and intermediate goods end up in their ultimate final use by the consumer. The figure uses three types of industry classifications:

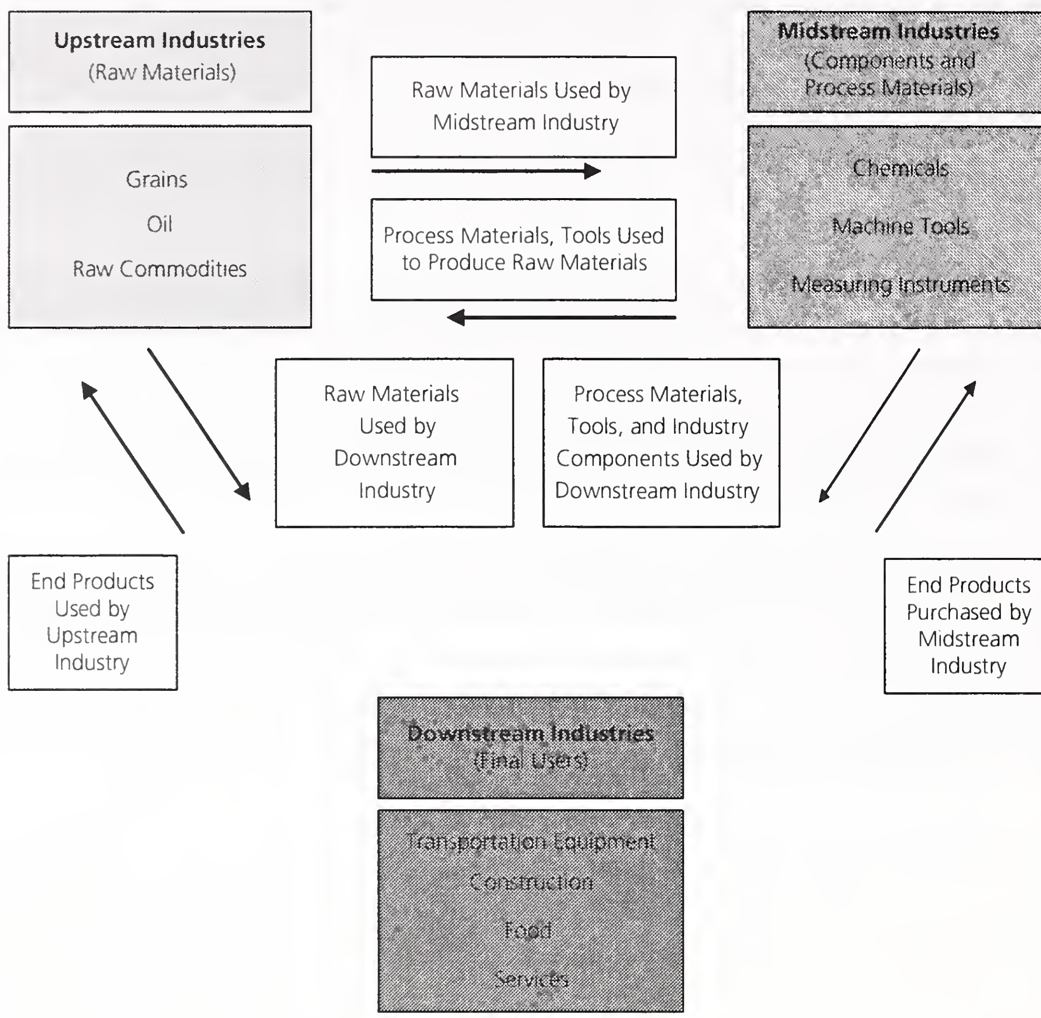
- **upstream,** which represents the industries that produce basic raw materials such as oil and grains;
- **midstream,** which refers to industries that produce a wide variety of products which are used by other industries to produce an end product or deliver a service; and
- **downstream,** which refers to those industries in which finished products or services are produced

The upper left-hand box in figure 3-1 shows the upstream industries, the upper right-hand box represents midstream industries, and the box below them represents downstream industries. Raw materials are extracted or grown by upstream industries. The midstream companies transform those goods into intermediate goods. Downstream industries purchase the intermediate goods and produce end-use products.

An example of this process is the making of an automobile. Upstream producers extract iron ore, copper, oil, and other raw commodities. Intermediate goods producers convert iron ore into steel, and fabricated metal shops transform this steel into the various parts of an auto body. Smelters take the copper ore to produce copper for use by wire manufacturers; these then turn the copper into fine copper wire for the electrical components of automotive electronics. Utilities convert oil or coal into electricity. Auto manufacturers purchase the metal, copper, and plastic parts as well as engines, transmissions, and tires. Using electricity purchased from a utility, the auto manufacturer assembles the various parts into motor vehicles.

The process described above is linear and sequential. However, as shown in figure 3-1, the process includes feedbacks from the downstream to the midstream and upstream industries as well as from midstream to upstream industries. For example, farmers purchase transportation equipment such as tractors and trucks from downstream industries, and intermediate goods are consumed by upstream industries. An example of an ATP project enabling a better intermediate good to be used by a raw material producer is found in Pelsoci (2004). In that ATP project, a materials producer created an improved oil drilling part, known as a riser, which allows oil extractors to drill for oil in water depths previously unavailable to them. Another ATP project exam-

FIGURE 3-1. Simple Model of the Economic Pathways through Which Different Industries Produce Goods for Each Other



Source: Authors.

ple involves a producer of catalysts for the natural gas industry. Natural gas producers increase their yield of usable natural gas through improved removal of nitrogen and other impurities.

THE NAICS ASSIGNMENT PROCESS

Beginning with their baseline report—i.e., the first BRS survey given to all ATP project participants at the beginning of a project—companies are asked to identify potential commercial applications resulting from the technology developed from their ATP

project. In subsequent annual surveys, they are asked whether any new applications emerged and whether existing ones are still applicable. In this research, the authors collected all commercial applications listed by participating companies in the BRS beginning with projects that started in 1999, when the web-based version of the BRS was implemented, up to January 31, 2004. Depending on how long a company's project had progressed, each participant completed between one and four BRS reports. Some projects had already been completed; others had been terminated early. Sometimes a company completed a baseline report, but did not report commercial applications until the project's first anniversary.

The raw data set resulted in 1,786 observations of potential applications. Because companies were asked in later surveys whether the application was still viable, there are duplicate observations in this set. We coded all commercial applications even if a project had been terminated or the commercial application was indicated to be nonviable in subsequent annual surveys. After eliminating those observations where there was baseline information but no commercial applications and duplicate commercial applications captured in the annual surveys, 852 unique commercial applications remained, involving 372 unique companies participating in 265 unique projects.

We examined each project participant individually in order to code its own-industry, i.e., the primary industry in which the company operates. In making this determination, the three-digit NAICS codes (if reported by the company) provided some guidance; we additionally relied on Compustat information for NAICS codes for public companies and the Hoover's database for private companies. If more than one NAICS or SIC code was listed for the company, we used the one that appeared most closely related to the technology used in the project. If neither Hoover's nor Compustat listed any codes, we conducted further web searches to identify the own-industry code. Through this process, each project participant was assigned a unique own-industry NAICS code.

A similar process was followed to determine the most common use-industry of each application. In many cases, defining the industry of the commercial application was more difficult than defining the own-industry. The commercial application titles provided by the companies tend to be short; these are frequently either too broad-based (e.g., "Auto") or vague (e.g., "Drug Discovery"). Second, because these products and services are often completely new commercial lines of business, no specific NAICS code yet exists to describe them. We often used the long description of the project that the company provided at the beginning of a project as a way to better understand the applications being proposed. Companies were also asked whether the commercial application was a new product, service, license, or process. This infor-

mation helped clarify the potential usage for the product, and was helpful in determining appropriate NAICS codes.

EXAMPLES OF THE NAICS ASSIGNMENT PROCESS

This section presents three examples of the NAICS assignment process to better illustrate the methodology and the challenges faced in implementing it.

- THM Biomedical participated in a single-applicant project awarded by ATP; the project began in 1999. Based on the project abstract, THM Biomedical proposed a new bio-absorbable implant intended to affect the repair and regeneration of articular cartilage defects, including the layer attached to the bone. It proposed a single commercial application described as "articular cartilage repair." Sometime during the project, the Kensey Nash Corporation purchased THM Biomedical. Since Kensey Nash is a publicly traded corporation, it has its own-industry NAICS code from the Compustat database—339112, Surgical and Medical Instrument Manufacturing. However, the commercial application was described as a product, not a process. Since this type of material would be placed inside the patient, it was not really an instrument. NAICS code 339113 is for Surgical Appliance and Supplies Manufacturing; one of the categories within that code is surgical implants manufacturing. Therefore, we classified the own-industry as NAICS code 339112, and the use-industry as 339113.

- Thar Technologies participated in a single-company project beginning in 2002. It proposed development of a miniature, low-cost vapor compression system—a "cooler on a chip"—for microelectronics applications. Thar envisioned two potential applications to be licensed: a microelectronics cooling system and application within the air-conditioning industry. Thar Technologies is listed in the Hoover's database under the industry description NAICS code 334516, Analytical Laboratory Instrument Manufacturing. We classified the downstream industry for the microelectronics cooling system as NAICS code 334418, which is the Printed Circuit Board Manufacturing. The second application was classified as NAICS code 333415, which is the Air-conditioning Manufacturing.

- Coding a joint venture was even more complicated, as it was often difficult to identify what each of the participants would commercialize in a particular project based on the brief commercial descriptions provided. In 2001, a joint venture was formed among three private companies (Kahuku Shrimp Company, Zeigler Brothers, and Pig Improvement Company) and the Scripts Oceanic Institute to

study shrimp genetics. The research institute was classified with the own-industry NACIS code 541710, which is research and development in the physical sciences. Two of the small companies were found in Hoover's: Kahuku Shrimp Company was classified as NAICS code 112512, which is Shrimp production through farming, as opposed to catching fish, which is NAICS code 114112 Shellfish fishing; and Pig Improvement Company was classified as NAICS code 112210, which is Hog and Pig Farming. To classify Ziegler Brothers, which could not be found in Hoover's, we looked at the company's website and learned that it manufactures premium feed for the zoo and agriculture industries. We therefore decided to include it in the Other Animal Food Manufacturing industry which is NAICS code 311119.

- The Scripps Oceanic Institute proposed an application for something it called "bio-secure shrimp production," a technology it proposed to license. Kahuku proposed an application with the same name, but described it as a new product. We assumed that one company might actively commercialize the technology and one would license the technology to companies operating in that industry; we decided that both applications would be commercialized within the Shrimp Farming industry and coded them NAICS code 112512, Shellfish Fishing. Kahuku proposed a second application simply called "biotechnology," which we coded as something to be used by the R&D sector, NAICS code 541710. Pig Improvement proposed an application called "shrimp genetics," which we also coded as 541710. Finally, Ziegler Brothers proposed a license for a technology called "BioZest," which we assumed would be used by the shrimp industry and we coded the use-industry as such.

The decision process is summarized in table 3-2.

Note that, when displayed in a table, the process may appear straightforward; however, it took much detective work and analysis to assign NAICS codes to ATP participants (own-industry) and applications (use-industries). Ultimately, one can observe how much variety in expertise is brought to the latter joint venture project. The Pig Improvement Company's expertise is concentrated in pig production, but it may be able to bring some fresh insight to shrimp genetics. An animal feed manufacturer adds expertise to the shrimp food side. The fact is that different producers from various industries bring unique skills and knowledge sets to this project. All of these conditions stimulate the potential for spillovers.

Table 3-1. Summary of Decision Process to Assign Own-Industry NAICS Codes and Use-Industry NAICS Codes: Three Examples

Company	Own-industry NAICS Code	Technology Application	Use-industry NAICS Code
Kensey Nash Corporation	339112: Surgical Medical Instrument Manufacturing	Articular cartilage repair	339113: Surgical Appliance and Supplies Manufacturing (surgical implants manufacturing)
Thar Technologies	334516: Analytical Laboratory Instrument Manufacturing	Microelectronics cooling system	334418: Printed Circuit Board Manufacturing 333414: Air Conditioning Manufacturing
Joint Venture:			
Kahuku Shrimp Company	112512: Shrimp Farming	Bio-secure shrimp production;	112512: Shrimp Farming
		Biotechnology	541710: R&D in the Physical Sciences
Zeigler Brothers	311119: Other Animal Food Manufacturing	Biozest	112512: Shrimp Farming
Pig Improvement Company	112210: Hog and Pig Farming	Shrimp genetics	541710: R&D in the Physical Sciences
Scripts Oceanic Institute	541710: R&D in the Physical Sciences	Bio-secure shrimp production	112512: Shrimp Farming

4

Data Analysis

LARGE INCREASE IN NUMBER OF INDUSTRIES COVERED BY ATP PROJECTS

As Jaffe (1996) notes, market and knowledge spillovers are more likely to occur when the technology may be used in many different applications, particularly technology that may be applied outside of developer's own-industry. The transition from three- to six-digit NAICS codes results in a large increase in the available detail of the ATP portfolio as measured by the number of different industries potentially affected by ATP-funded technology. Table 4-1 shows the increase in unique three- and six-digit NAICS codes before and after the coding. The number of unique six-digit own-industries is 106; the number of unique six-digit downstream industries is 180.

TABLE 4-1. Number of Unique NAICS Codes Assigned to ATP Projects, 1999–2004

Industry	Unique Six-Digit NAICS Codes (After Coding)
Own	106
Use	180

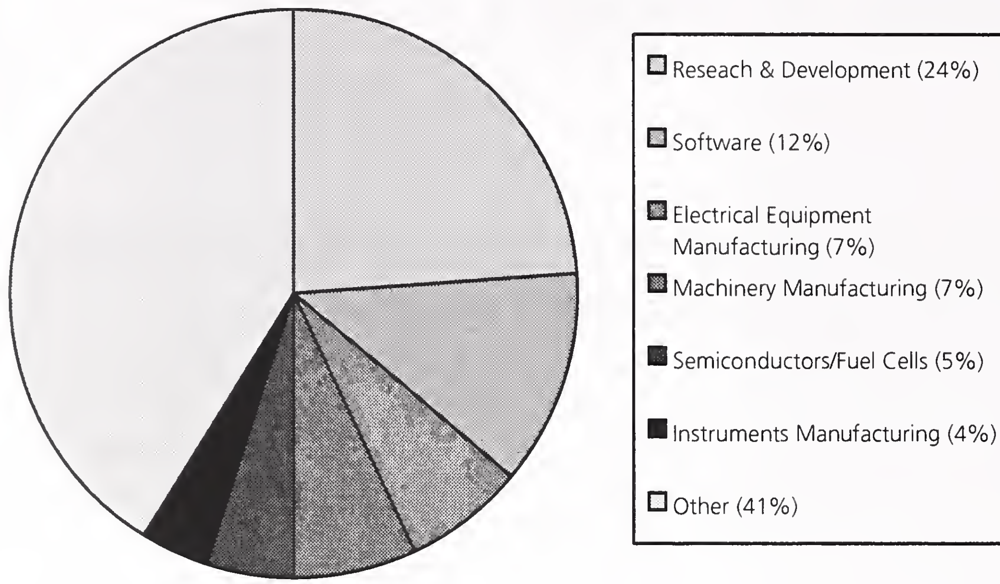
Source: BRS, NAICS coding.

DISTRIBUTION OF OWN-INDUSTRY FOR ATP PARTICIPANTS

Figure 4-1 shows the distribution of own-industries for ATP participants. The largest own-industry is NAICS code 541710, Research and Development in the Physical Sciences. This represents almost a quarter of all participants' own-industry categorizations.

FIGURE 4-1. Distribution of Own-Industry for ATP Participants by Six-Digit NAICS Code

(Projects Started between January 1999 and July 2004)



Source: BRS, NAICS coding.

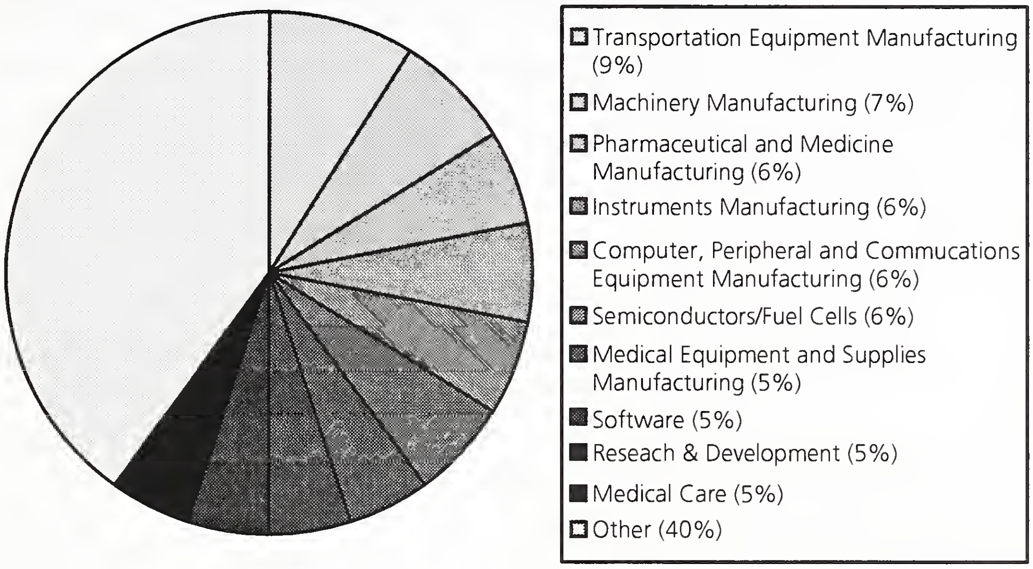
As shown by figure 4-1, other own-industries include software, electrical equipment manufacturing and semiconductors. These industries may be characterized as midstream industries as shown on figure 3-1. They typically provide inputs to the upstream and downstream industries. This graph only provides the counts of the number of firm's own-industry within each industry and is not adjusted for dollars spent per project or the fact that a single joint venture might contribute several companies to these counts while a single applicant provides only one. A disproportionate number of ATP company participants are small firms, many of them are relatively new, and consider their primary business at this stage to be research and development. This fact explains the relatively large number of ATP firms whose own-industry is the R&D industry. As they develop commercial products, many of them will reclassify themselves into the NAICS code of their new industry.

DISTRIBUTION OF USE-INDUSTRY FOR ATP PARTICIPANTS

An examination of figures 4-1 and 4-2 reveals differences between own- and use-industries. The own-industry category contains a significant number of R&D and

FIGURE 4-2. Distribution of Use-Industry for ATP Participants by Six-Digit NAICS Code

(Projects Started between January 1999 and July 2004)



Source: BRS, NAICS coding.

software firms as well as instrument and machinery manufacturers (about 45 percent of total own-industry). Own-industries are likely to be characterized as midstream industries, which provide components, materials, and process technologies for both upstream and downstream industries.

Use-industries, on the other hand, include transportation equipment, medical care, computer manufacturing, and pharmaceutical manufacturing. Such industries are more likely to be characterized as downstream industries, which purchase components from midstream industries to assemble their products or deliver their services.

The "other" category in both figures 4-1 and 4-2 includes many NAICS codes too numerous to list here. However, appendix B contains a list of all own and use-industry NAICS codes by commercial application.

DO ATP PARTICIPANTS' OWN-INDUSTRIES GENERATE TECHNOLOGY?

The Carnegie Mellon Heinz Business School conducted a study of NAICS codes and technology industries.[1] The researchers defined "technology employer industries" as those that employ three times the national average of employees in R&D, or almost 10 percent. They defined an industry as a "primary technology generator" if the industry per employee R&D expenditures exceeds the national average of $11,297 and if the industry's proportion of R&D scientists and engineers to total employees exceeds the U.S. average of 6.5 percent. A secondary technology generator industry meets one of these two criteria.

Using these definitions, we analyzed ATP participants' own- and use-industries to determine the percentage of firms that are in industries known as technology employers and either primary or secondary technology generators. Table 4-2 shows the results of this analysis.

TABLE 4-2. Percentage of ATP Participant Firms in Industries Characterized as Technology Employers and/or Primary or Secondary Technology Generators, 1999–2004

Industry	Technology Employers	Primary Technology Generator	Secondary Technology Generator	Total Primary and Secondary Generators
Own	60	55	5	60
Use	29	26	8	33

Sources: BRS, NAICS coding; Paytas and Berglund (2004).

An ATP firm's own-industry is more likely to be a technology employer and/or a primary or secondary technology generator than its use-industry. This finding suggests that ATP companies participate in technology-generating industries, but that the benefits go to users in industries less likely to be a significant generator of technology. It may be an indication that ATP catalyzes research by R&D performers whose spillover benefits may accrue to predominately non-R&D performers although further research would be necessary to answer this question.

1. Paytas and Berglund (2004).

EVIDENCE OF MULTI-USE TECHNOLOGIES

Multi-use technologies possess high spillover potential. One way to measure such potential in ATP projects is to see whether project participants' own-industry differs from the use-industry of their proposed commercial applications.

Table 4-3 indicates that most ATP participants propose a commercial application outside of their own-industry. In fact, 84 percent of project participants propose at least one commercial application outside of their own-industry's six-digit NAICS code.

TABLE 4-3. Percentage of ATP Participants That Propose at Least One Commercial Application Outside of Their Own-Industry, 1999–2004

Technology Area	Percentage of Participants
Overall	84
Biotechnology	82
Chemicals/materials	88
Electronics	82
Information technology	80
Manufacturing	82

Source: BRS, NAICS coding.

Potential diffusion of ATP-funded technologies is fairly consistent across the five technology areas that ATP uses to classify projects (listed in table 4-3); over 80 percent of all project participants within each technology area propose at least one application outside of their own-industry. Across all commercial applications, almost half are outside of the participant's own-industry.

EVIDENCE OF INFRASTRUCTURAL TECHNOLOGIES

Infrastructural technologies support the development of generic technologies and subsequent market applications, and may be described as "tools for the toolmakers." The first method used to determine infrastructural technologies was whether the proposed commercial application use-industry was the R&D industry (NAICS code

541710). Recall from figure 4-1 that almost a quarter of all own-industry participants were in the R&D industry. However, only 5 percent of use-industry applications are in the R&D industry.

We divided use-industry applications into the five ATP technology categories, and we found that biotechnology had the most use-industry commercial applications for the R&D industry. In fact, almost one out of five (17.8 percent) commercial applications in biotechnology may be used by the R&D industry.

Advances in biotechnology tools drive biotechnology's R&D industry. In the past 10 years, more than 45 ATP awards have supported the development of diagnostic tools used to isolate and evaluate genetic information. Developments include production of a nucleic acid micro-array, a micro-fluidic system, an informatics package, and an integrated platform that offers faster and cheaper methods of producing genetic data on a routine basis.[2]

DO ATP PARTICIPANTS INTEND TO LICENSE ATP-FUNDED TECHNOLOGY OUTSIDE OF OWN-INDUSTRY?

Jaffe's third factor suggests the potential for spillovers is high when the proposed commercial application is outside of the own-industry and the commercial strategy is to license. Licensing provides an avenue for knowledge diffusion while improving the welfare of producers and customers. For example, a firm may develop a technology but lack the expertise or willingness to commercialize it outside of its own-industry. A license allows another firm to develop the commercial application for the industry; presumably, it costs less to license the technology than to develop it in-house. The firm that developed the technology receives a licensing fee, which defrays some of the costs of developing the technology, and provides an incentive for further development of enabling technology.[3] Sometimes proposed commercial applications become impractical or unfeasible as the project progresses. Therefore, ATP queries companies each year about whether any proposed commercial applications are still viable. Table 4-4 presents an analysis of whether a commercial application was outside of the own-industry and whether those applications are still viable. An application is considered viable if the company indicated so in its last submitted BRS report (as of January 31, 2004).

2. www.atp.nist.gov/eao/2004annual/2004annual.pdf.

3. To the extent that the licensor possesses market power then the spillover benefit may be somewhat negated. But, a new technology may not be a perfect substitute for the existing technology, and therefore, the licensor may have to reduce the price somewhat in order to induce the firm to purchase their license.

The proportion of applications that are licensed outside of their own-industry is between 10 and 20 percent across the five technology areas. In four areas, at least 80 percent of the applications are still viable. The comparable proportion in manufacturing is somewhat lower: in this area, applications retain their commercial viability in a little over half of the time.

TABLE 4-4. Percentage of Firms Licensing ATP Technology Outside of Their Own-Industry and Whether the Commercial Application Is Still Viable
(Projects Started January 1999–January 2004)

Technology Area	Firms Licensing Outside of Own-Industry	Firms Licensing Outside of Own-Industry Whose Applicable Is Still Viable
Biotechnology	14	96
Chemicals/materials	11	81
Electronics	13	95
Information technology	18	81
Manufacturing	10	55

Source: BRS, NAICS coding.

DO APPLICATIONS OUTSIDE OWN-INDUSTRY REMAIN COMMERCIALLY VIABLE?

Table 4-5 shows the extent to which proposed commercial applications remain viable as the project progresses. It shows that the proportion of applications reported as still viable since the last report is in the 90 percent range until project closeout; even then, the proportion only drops to slightly below 80 percent.

As Ruegg (1999) suggests, developing technology outside of one's own-industry can be difficult. We analyzed whether participants' commercial applications were outside of their own-industry and what percentage is still viable based upon each participant's latest submitted BRS report. Table 4-6 shows the data by technology area. The still-viable designation is based on the last report submitted involving each application.

TABLE 4-5. Percentage of Applicants Reporting Their Commercial Application as Still Viable
(Projects Started January 1999–January 2004)

Report	Application still viable
Baseline	91
First anniversary	92
Second anniversary	91
Third anniversary	93
Closeout	79

Source: BRS, NAICS coding.

TABLE 4-6. Percentage of Commercial Applications That Are Still Viable Outside of a Participant's Own-Industry
(Projects Started January 1999–January 2004)

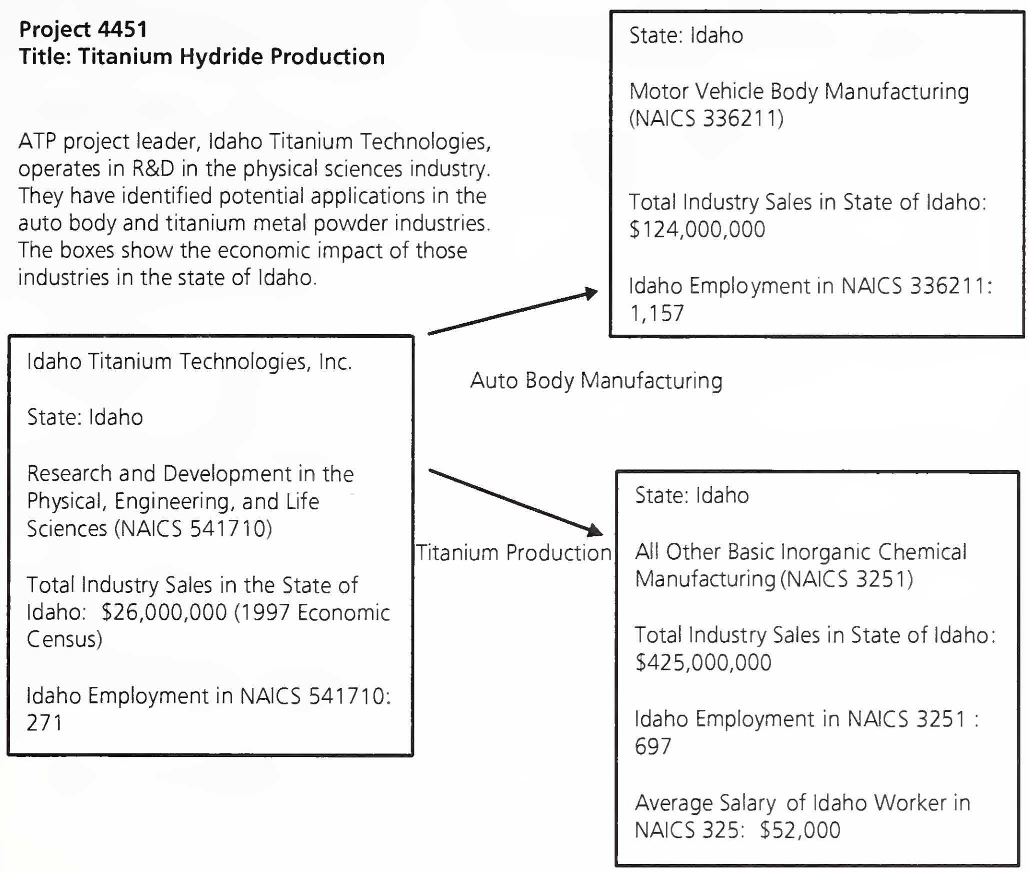
Technology Area	Commercial Applications Still Viable Outside Own-industry
Biotechnology	88
Chemicals/materials	89
Electronics	91
Information technology	88
Manufacturing	95

Source: BRS, NAICS coding.

OTHER WAYS TO USE THE DATA

Figures 4-3 and 4-4 illustrate the use of NAICS codes to explain how an ATP project diffuses technology from midstream to downstream industries. NAICS data are available at the national, state, and county levels, so different levels of industry aggregation can be selected to make this point. The example provided in figure 4-3 involves a titanium project based in Idaho. This project encompasses two applications, motor vehicle body and titanium powders, both of which industries are important to the Idaho economy. The project originates from a small research company specializing in titanium powders. If the project is successful, the benefits will flow into the Idaho economy through use by the motor vehicle body manufacturing sector, which gener-

FIGURE 4-3. A Demonstration of Potential Economic Benefits to the State of Idaho Resulting from Spillovers of an ATP Project

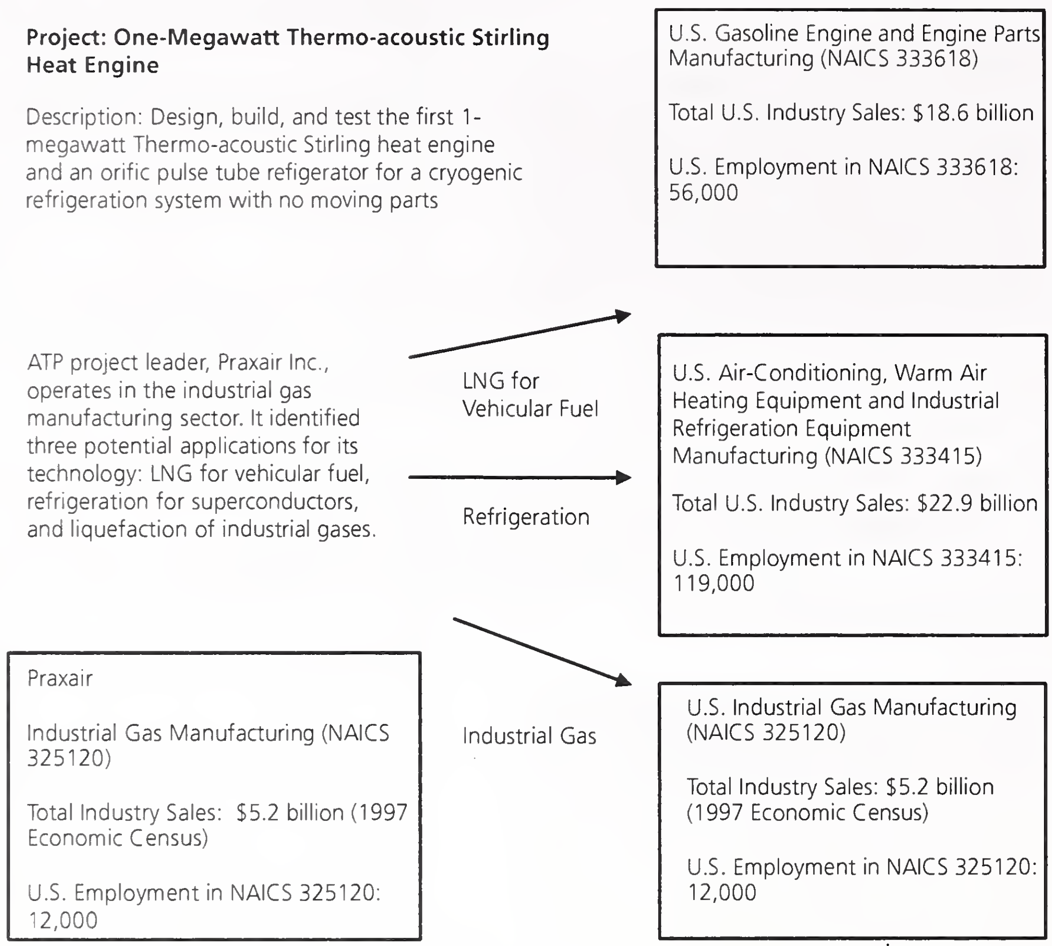


Source: 1997 Economic Census.

ated $126 million in sales in 1997 for Idaho and the inorganic chemical manufacturing sector, which generated sales of $450 million and whose jobs pay an average of $52,000.

Figure 4-4 illustrates the potential benefits from a "Stirling engine" project involving Praxair Corporation. The company proposes three possible commercial applications: gasoline engines, air-conditioning and industrial gas manufacturing. The US markets for these industries are $18.6, $22.9 and $5.2 billion, respectively. Success in this project could potentially be diffused into markets totaling almost $50 billion employing over 180,000 people.

FIGURE 4-4. A Demonstration of Potential Economic Benefits to the Nation Resulting from Spillovers of an ATP Project



Source: 1997 Economic Census.

APPENDICES AND DISCUSSION

Appendix A contains the list of Jaffe's factors affect market and knowledge spillovers. We analyzed three of these factors. We found evidence that ATP selects projects with the potential for broad economic impact. Multi-use technologies provide both market and knowledge spillovers. ATP enables multi-use technology development by either selecting single-applicant projects where the potential commercial applications are multiple and extend outside of the firm's own-industry or though selecting joint ventures such as the shrimp genetics' project involving multiple partners from a disparate set of own-industries; proposing commercial applications outside of their own-industry.

Other factors that lead to spillovers include projects where the commercial application involves research tools. We found that biotechnology is the technology area most likely to involve the use-industry research and development in the physical sciences; this is called an infrastructural technology. These may be also referred to as "tools for the toolmaker." As the Biotechnology Industry Organization states:[4]

> Researchers use biotechnology to gain insight into the precise details of cell processes... Interestingly, the tools of biotechnology have also become important research tools in many branches of science other than cell and molecular biology, such as chemistry, engineering, materials science, ecology, evolution and computer science. The biotech-driven discoveries in these fields help the biotech industry and others discover and develop products, but they also help industries improve their performance in areas such as environmental stewardship and workplace safety.

As indicated by the above statement, biotechnology tool development has led to great spillover benefits outside of biotechnology and has spread throughout other sectors of the economy such as energy and agriculture. ATP contributes to this effort.

Appendix B contains the lists for each technology area of own- and use-industry counts by commercial application. These lists provide an overall view of the ATP portfolio and the potential impacts that ATP projects have on which industries. These lists may be used as an inventory of the areas that ATP enables at a given time and may be used with lists from other government programs in order to compare across the entire government's R&D portfolio, as was suggested by the 2002 Presidential Committee of Advisors and Science and Technology report, *Assessing the U.S. R&D Investment*.

4. www.bio.org/speeches/pubs/er/biotechtools.asp.

5

Key Findings and Suggestions for Future Research

KEY FINDINGS

The key findings of the report are as follows: the predominant six-digit NAICS own-industry of ATP project participants is research and development in the physical sciences followed by the software, electronic machinery, and machinery manufacturing industries. All of these industries could be characterized as mid-stream industries. These intermediate goods producers supply inputs to the upstream and downstream industries.

The distribution of use-industries is more diffuse. The most common use-industries include transportation equipment, computer hardware, pharmaceuticals, and electronic manufacturing. The use-industries are more likely to be characterized as downstream industries.

Fifty-five percent of participants' own-industries may be characterized as primary technology generators, while only 23 percent of participants' use-industries may be characterized as primary technology generators.

There is evidence ATP selects projects with potential for broad economic impact, based on the fact that a significant portion of proposed commercial applications involves an industry that is different from the project participant's own-industry. Biotechnology is the technology area most likely to involve the use-industry research and development in the physical sciences; this is called an infrastructural technology.

In another indication of spillover impact, we discovered that 10 to 18 percent of commercial applications, depending on the technology area, involve licensing

outside of their own-industry. These are projects where technology is developed by a company for their own-industry application, but they plan to license it outside of the own-industry. This situation typically allows a developing company to concentrate on commercializing the technology in the market where it presumably has more expertise, while allowing the licensing firm to commercialize the technology in its different own-industry, where it presumably possesses more expertise in commercializing the technology.

SUGGESTIONS FOR FUTURE RESEARCH

Future work should focus on matching commercialization and patent outcomes data to the NAICS coding. Then, an inventory could be kept of which industries are affected by commercialization (market spillovers) and patent generation (knowledge spillovers) and which are not. The next step would be to apply the Scherer technology flow approach and use these data to determine the technology flows that result from ATP-enabled technology. This could be simply assigning the dollars spent on each project and then allocating them across the commercial applications. This would measure the potential spillover effects while one could also apply the commercial outcomes that actually occur and restrict allocation of the potential gains to them.

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A

Appendix Factors Affecting Market and Knowledge Spillovers

The following factors are summarized from Jaffe (1996).

Factors making market spillovers larger or more likely:

- Market in which innovation will be used or sold is highly competitive
- Lead time and learning curves are not likely to give innovator strong market advantages
- Technology is infrastructural, i.e., other researchers are a significant component of the market for the new technology
- Output is product innovation that would be difficult to patent or copyright
- Co-specialized assets are important in the relevant markets, and project proponents do not have important assets
- Regulatory approvals are needed
- Sales/service is important
- Reputation/market presence is important
- Licensing of the technology to others is likely to be important
- Multi-use innovation, where many uses are likely to be commercialized by others

- Process technology, proponents are small (or not) producers in relevant markets
- Capital needs for ultimate commercialization are beyond proponents' reach

Factors making market spillovers smaller or less likely:

- Proponents have market power in the relevant markets
- Lead time and learning curves can be expected to convey significant advantages on the innovator if the project is successful
- Output is product innovation that can be protected by patent or copyright
- Proponents have important co-specialized assets
- Technical success will lead to a large negative profit impact on another firm or firms whose technology will thereby be made obsolete

Factors making knowledge spillovers larger or more likely:

- Multi-use technology
- Proof of concept that would point the way for other researchers to try related ideas in other applications
- Key component that will facilitate redesign and improvement of multiple distinct systems using that component
- "Path-breaking" technology: success will open an entirely new line of technological development with apparently significant economic benefits
- Subsequent technical developments require expertise in applications technologies in which proponents do not have relevant expertise (applies to both multi-use and path-breaking technologies
- Useful knowledge would be gained even if project fails to achieve its technical objectives

Factors making knowledge spillovers less likely:

- Output is process innovation that can be kept secret, and project proponents can use it in their own production process

- Project proponents have special technical expertise that would position them to be the most likely developers of many of the follow-on technologies

Factors making interacting knowledge and market spillovers likely:

- Output is "infratechnology:" technology has attributes of a standard and thereby generates network spillovers
- Output is a product that would be sold to other researchers
- Output is product innovation that would be difficult to patent or copyright

Appendix ATP Commercialization Portfolio, by Sector

B

ATP Biotechnology Commercialization Portfolio (Jan. 1999– Jan. 2004) Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Other Vegetable (except Potato) and Melon Farming	Other Vegetable (except Potato) and Melon Farming	1
Hog and Pig Farming	Research and Development in the Physical, Engineering, and Life Sciences	1
Finfish Farming and Fish Hatcheries	Finfish Farming and Fish Hatcheries	3
Shellfish Farming	Shellfish Farming	1
	Research and Development in the Physical, Engineering, and Life Sciences	1
Dog and Cat Food Manufacturing	Shellfish Farming	1
Cellulosic Organic Fiber Manufacturing	Biological Product (except Diagnostic) Manufacturing	4
Pharmaceutical Preparation Manufacturing	Biological Product (except Diagnostic) Manufacturing	1
	Medical Laboratories	1
Biological Product (except Diagnostic) Manufacturing	Hog and Pig Farming	2
	Biological Product (except Diagnostic) Manufacturing	6
	Research and Development in the Physical, Engineering, and Life Sciences	1
	General Medical and Surgical Hospitals	4
Porcelain Electrical Supply Manufacturing	Glass Product Manufacturing Made of Purchased Glass	1

ATP Biotechnology Commercialization Portfolio (Jan. 1999– Jan. 2004)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	Analytical Laboratory Instrument Manufacturing	4
	Offices of Physicians (except Mental Health Specialists)	1
Electronic Coil, Transformer, and Other Inductor Manufacturing	Diagnostic Imaging Centers	1
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	Finfish Farming and Fish Hatcheries	3
Analytical Laboratory Instrument Manufacturing	Medical Laboratories	2
Other Measuring and Controlling Device Manufacturing	Pharmaceutical Preparation Manufacturing	1
	Other Measuring and Controlling Device Manufacturing	1
Laboratory Apparatus and Furniture Manufacturing	Biological Product (except Diagnostic) Manufacturing	2
Surgical and Medical Instrument Manufacturing	Biological Product (except Diagnostic) Manufacturing	1
	Electromedical and Electrotherapeutic Apparatus Manufacturing	2
	Surgical and Medical Instrument Manufacturing	2
	Surgical Appliance and Supplies Manufacturing	1
	Research and Development in the Physical, Engineering, and Life Sciences	1
	Offices of Physical, Occupational and Speech Therapists, and Audiologists	1
	Blood and Organ Banks	1
Surgical Appliance and Supplies Manufacturing	Surgical Appliance and Supplies Manufacturing	11
Data Processing, Hosting, and Related Services	Diagnostic Imaging Centers	1
Offices of Notaries	Offices of Notaries	3
Custom Computer Programming Services	Pharmaceutical Preparation Manufacturing	1
	Biological Product (except Diagnostic) Manufacturing	2
	Analytical Laboratory Instrument Manufacturing	3
	Research and Development in the Physical, Engineering, and Life Sciences	3

ATP Biotechnology Commercialization Portfolio (Jan. 1999– Jan. 2004) Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
	Medical Laboratories	2
Computer Systems Design Services	Research and Development in the Physical, Engineering, and Life Sciences	1
	Medical Laboratories	1
Research and Development in the Physical, Engineering, and Life Sciences	Crop Production	1
	Other Vegetable (except Potato) and Melon Farming	2
	Dual-Purpose Cattle Ranching and Farming	1
	Hog and Pig Farming	1
	Turkey Production	1
	Poultry Hatcheries	5
	Sheep Farming	2
	Shellfish Farming	1
	Soil Preparation, Planting, and Cultivating	2
	Pharmaceutical Preparation Manufacturing	7
	Biological Product (except Diagnostic) Manufacturing	20
	Semiconductor and Related Device Manufacturing	1
	Electromedical and Electrotherapeutic Apparatus Manufacturing	2
	Analytical Laboratory Instrument Manufacturing	4
	Surgical Appliance and Supplies Manufacturing	12
	Research and Development in the Physical, Engineering, and Life Sciences	27
	All Other Business Support Services	1
	Offices of Physicians (except Mental Health Specialists)	2
	Freestanding Ambulatory Surgical and Emergency Centers	1
	Medical Laboratories	6
	General Medical and Surgical Hospitals	5
Medical Laboratories	Biological Product (except Diagnostic) Manufacturing	2
Diagnostic Imaging Centers	Research and Development in the Physical, Engineering, and Life Sciences	1
	Diagnostic Imaging Centers	2
Grantmaking Foundations	General Medical and Surgical Hospitals	1
Conglomerate	All Other Miscellaneous Fabricated Metal Product Manufacturing	2
	Irradiation Apparatus Manufacturing	1

ATP Chemical and Materials Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Fabricated Metal Product Manufactur	Natural Gas Liquid Extraction	2
Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	All Other Miscellaneous Electrical Equipment and Component Manufacturing	1
Management Consulting Services	Industrial Mold Manufacturing	1
Coated and Laminated Paper Manufacturing	Other Computer Peripheral Equipment Manufacturing	2
Industrial Gas Manufacturing	Semiconductor and Other Electronic Component Manufacturing	1
	Other Electric Power Generation	1
	Industrial Gas Manufacturing	4
	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	1
	Other Engine Equipment Manufacturing	1
	Storage Battery Manufacturing	1
	Other Motor Vehicle Electrical and Electronic Equipment Manufacturing	1
	Surgical and Medical Instrument Manufacturing	1
All Other Basic Inorganic Chemical Manufacturing	Current-Carrying Wiring Device Manufacturing	1
Synthetic Rubber Manufacturing	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	3
Cellulosic Organic Fiber Manufacturing	Semiconductor and Related Device Manufacturing	1
Pharmaceutical Preparation Manufacturing	Biological Product (except Diagnostic) Manufacturing	2
Soap and Other Detergent Manufacturing	Chemical Manufacturing	4
Nonclay Refractory Manufacturing	Other Electric Power Generation	1
Mineral Wool Manufacturing	Polystyrene Foam Product Manufacturing	3
	Gypsum Product Manufacturing	1
All Other Miscellaneous Nonmetallic Mineral Product Manufacturing	Electronic Computer Manufacturing	2
	Aircraft Manufacturing	1
	Military Armored Vehicle, Tank, and Tank Component Manufacturing	1
	Surgical and Medical Instrument Manufacturing	1

ATP Chemical and Materials Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
	Game, Toy, and Children's Vehicle Manufacturing	1
Iron and Steel Mills	Crude Petroleum and Natural Gas Extraction	1
	Turbine and Turbine Generator Set Units Manufacturing	1
	Aircraft Manufacturing	1
Copper Rolling, Drawing, and Extruding	Other Aluminum Rolling and Drawing	1
Nonferrous (except Aluminum) Die-Casting Foundries	Polystyrene Foam Product Manufacturing	1
Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	Machine Tool (Metal Cutting Types) Manufacturing	1
	Automobile Manufacturing	1
	Surgical Appliance and Supplies Manufacturing	1
Electroplating, Plating, Polishing, Anodizing, and Coloring	Inorganic Dye and Pigment Manufacturing	1
	Semiconductor and Related Device Manufacturing	1
	Primary Battery Manufacturing	1
	Current-Carrying Wiring Device Manufacturing	1
Ball and Roller Bearing Manufacturing	Ball and Roller Bearing Manufacturing	1
Construction Machinery Manufacturing	Ornamental and Architectural Metal Work Manufacturing	1
	Automobile Manufacturing	3
Semiconductor Machinery Manufacturing	Semiconductor and Related Device Manufacturing	1
	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	2
Optical Instrument and Lens Manufacturing	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	1
Special Die and Tool, Die Set, Jig, and Fixture Manufacturing	Motor Vehicle Body Manufacturing	1
Cutting Tool and Machine Tool Accessory Manufacturing	Motor Vehicle Transmission and Power Train Parts Manufacturing	1
Turbine and Turbine Generator Set Units Manufacturing	Power, Distribution, and Specialty Transformer Manufacturing	7
Mechanical Power Transmission Equipment Manufacturing	Mechanical Power Transmission Equipment Manufacturing	2
Industrial Process Furnace and Oven Manufacturing	Steel Wire Drawing	1

ATP Chemical and Materials Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
	Primary Aluminum Production	1
	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)	1
	Semiconductor and Related Device Manufacturing	1
	Electronic Resistor Manufacturing	1
	Electronic Coil, Transformer, and Other Inductor Manufacturing	2
	Electronic Connector Manufacturing	1
All Other Miscellaneous General Purpose Machinery Manufacturing	Natural Gas Liquid Extraction	2
	Petrochemical Manufacturing	1
Computer Storage Device Manufacturing	Computer Storage Device Manufacturing	1
	Current-Carrying Wiring Device Manufacturing	1
	Motor Vehicle Body Manufacturing	1
Telephone Apparatus Manufacturing	Telephone Apparatus Manufacturing	1
Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	Storage Battery Manufacturing	1
Semiconductor and Related Device Manufacturing	Other Electric Power Generation	2
	Industrial Gas Manufacturing	1
	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	3
	Semiconductor and Related Device Manufacturing	2
	Motor and Generator Manufacturing	1
	Storage Battery Manufacturing	1
Electronic Capacitor Manufacturing	All Other Miscellaneous Electrical Equipment and Component Manufacturing	1
Other Electronic Component Manufacturing	Semiconductor and Related Device Manufacturing	3
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	Automobile Manufacturing	5
Other Measuring and Controlling Device Manufacturing	Petroleum Refineries	2
	Petrochemical Manufacturing	1

ATP Chemical and Materials Commercialization Portfolio (1999–) Proposed Commercial Applications by Own-Industry and Use-Industry		
NAICS Own-Industry	**NAICS Use-Industry**	**Proposed Commercial Applications**
	Other Measuring and Controlling Device Manufacturing	2
Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	1
Power, Distribution, and Specialty Transformer Manufacturing	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	1
Motor and Generator Manufacturing	Motor and Generator Manufacturing	4
Storage Battery Manufacturing	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing	2
	Other Computer Peripheral Equipment Manufacturing	3
	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	1
	Electromedical and Electrotherapeutic Apparatus Manufacturing	2
	Storage Battery Manufacturing	2
	Aircraft Manufacturing	3
	Motion Picture and Video Production	1
Primary Battery Manufacturing	Electromedical and Electrotherapeutic Apparatus Manufacturing	2
	Primary Battery Manufacturing	5
Noncurrent-Carrying Wiring Device Manufacturing	Electric Bulk Power Transmission and Control	2
All Other Miscellaneous Electrical Equipment and Component Manufacturing	Other Electric Power Generation	1
	Turbine and Turbine Generator Set Units Manufacturing	2
	Storage Battery Manufacturing	2
	All Other Miscellaneous Electrical Equipment and Component Manufacturing	1
	Automobile Manufacturing	1
	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	1
	Military Armored Vehicle, Tank, and Tank Component Manufacturing	2
Automobile Manufacturing	Automobile Manufacturing	1
All Other Motor Vehicle Parts Manufacturing	Semiconductor and Related Device Manufacturing	1

ATP Chemical and Materials Commercialization Portfolio (1999–) Proposed Commercial Applications by Own-Industry and Use-Industry		
NAICS Own-Industry	**NAICS Use-Industry**	**Proposed Commercial Applications**
Aircraft Engine and Engine Parts Manufacturing	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	1
	Industrial Mold Manufacturing	2
	Gasoline Engine and Engine Parts Manufacturing	1
	Aircraft Manufacturing	1
Surgical Appliance and Supplies Manufacturing	Surgical Appliance and Supplies Manufacturing	3
Engineering Services	Research and Development in the Physical, Engineering, and Life Sciences	3
Computer Systems Design Services	Data Processing, Hosting, and Related Services	1
Research and Development in the Physical, Engineering, and Life Sciences	#N/A	3
	Broilers and Other Meat Type Chicken Production	1
	Finfish Farming and Fish Hatcheries	1
	Other Electric Power Generation	3
	All Other Basic Inorganic Chemical Manufacturing	1
	Plastics Material and Resin Manufacturing	1
	Noncellulosic Organic Fiber Manufacturing	2
	Pharmaceutical Preparation Manufacturing	1
	Biological Product (except Diagnostic) Manufacturing	1
	Air Purification Equipment Manufacturing	1
	Semiconductor and Related Device Manufacturing	4
	Storage Battery Manufacturing	2
	Primary Battery Manufacturing	2
	Carbon and Graphite Product Manufacturing	2
	All Other Miscellaneous Electrical Equipment and Component Manufacturing	1
	Motor Vehicle Body Manufacturing	1
	Surgical Appliance and Supplies Manufacturing	1
	Marketing Consulting Services	1
	Medical Laboratories	1
Colleges, Universities, and Professional Schools	Iron and Steel Forging	1
	Industrial Mold Manufacturing	1
	Medical Laboratories	1
Business Associations	Nonferrous (except Aluminum) Die-Casting Foundries	2

ATP Chemical and Materials Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
International Affairs	Steel Foundries (except Investment)	1
	Turbine and Turbine Generator Set Units Manufacturing	1
	Semiconductor and Related Device Manufacturing	2
	Electronic Capacitor Manufacturing	1
	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	1
	Irradiation Apparatus Manufacturing	2
	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	2

ATP Manufacturing Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Support Activities for Metal Mining	Industrial Mold Manufacturing	1
Rolled Steel Shape Manufacturing	Rolled Steel Shape Manufacturing	1
Nonferrous (except Aluminum) Die-Casting Foundries	Nonferrous (except Aluminum) Die-Casting Foundries	1
Prefabricated Metal Building and Component Manufacturing	Construction Machinery Manufacturing	1
All Other Miscellaneous Fabricated Metal Product Manufacturing	Mechanical Power Transmission Equipment Manufacturing	1
Construction Machinery Manufacturing	Ornamental and Architectural Metal Work Manufacturing	4
All Other Industrial Machinery Manufacturing	Magnetic and Optical Recording Media Manufacturing	1
Optical Instrument and Lens Manufacturing	Optical Instrument and Lens Manufacturing	1
Industrial Mold Manufacturing	Industrial Mold Manufacturing	1
Machine Tool (Metal Cutting Types) Manufacturing	Machine Tool (Metal Cutting Types) Manufacturing	2
Special Die and Tool, Die Set, Jig, and Fixture Manufacturing	Motor Vehicle Body Manufacturing	1
Cutting Tool and Machine Tool Accessory Manufacturing	Machine Tool (Metal Cutting Types) Manufacturing	1
	Special Die and Tool, Die Set, Jig, and Fixture Manufacturing	1
	Cutting Tool and Machine Tool Accessory Manufacturing	5
	Other Technical and Trade Schools	1
Welding and Soldering Equipment Manufacturing	Motor Vehicle Body Manufacturing	2
	Truck Trailer Manufacturing	1
	Other Aircraft Parts and Auxiliary Equipment Manufacturing	1
	Railroad Rolling Stock Manufacturing	1
	Ship Building and Repairing	1
Other Communications Equipment Manufacturing	Other Communications Equipment Manufacturing	1
Semiconductor and Related Device Manufacturing	Other Electric Power Generation	1

ATP Manufacturing Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	Power and Communication Line and Related Structures Construction	1
	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	7
	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	2
	Motor Vehicle Air-Conditioning Manufacturing	1
Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	Computer Storage Device Manufacturing	1
Motor and Generator Manufacturing	Automobile Manufacturing	2
Automobile Manufacturing	Motor Vehicle Body Manufacturing	2
	Motor Vehicle Transmission and Power Train Parts Manufacturing	1
Gasoline Engine and Engine Parts Manufacturing	Gasoline Engine and Engine Parts Manufacturing	1
Software Publishers	Relay and Industrial Control Manufacturing	1
Engineering Services	Turbine and Turbine Generator Set Units Manufacturing	1
	Household Refrigerator and Home Freezer Manufacturing	1
	Motor and Generator Manufacturing	2
	Motor Vehicle Body Manufacturing	1
	Other Aircraft Parts and Auxiliary Equipment Manufacturing	1
	Ship Building and Repairing	1
Testing Laboratories	Surgical and Medical Instrument Manufacturing	2
Custom Computer Programming Services	Other Building Equipment Contractors	1
	Turbine and Turbine Generator Set Units Manufacturing	1
	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	1
	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	1
	Relay and Industrial Control Manufacturing	1

ATP Manufacturing Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	1
	Ship Building and Repairing	1
Other Scientific and Technical Consulting Services	Machine Tool (Metal Cutting Types) Manufacturing	1
	Motor Vehicle Metal Stamping	1
	Other Aircraft Parts and Auxiliary Equipment Manufacturing	1
	Custom Computer Programming Services	1
Research and Development in the Physical, Engineering, and Life Sciences	Finfish Farming and Fish Hatcheries	1
	Water and Sewer Line and Related Structures Construction	4
	Motor Vehicle Body Manufacturing	1
	Motor Vehicle Seating and Interior Trim Manufacturing	1
	Aircraft Engine and Engine Parts Manufacturing	1
	Other Aircraft Parts and Auxiliary Equipment Manufacturing	1
	Deep Sea Freight Transportation	1
	Coastal and Great Lakes Freight Transportation	1
Colleges, Universities, and Professional Schools	Ball and Roller Bearing Manufacturing	1
	Machine Tool (Metal Cutting Types) Manufacturing	3
International Affairs	Aircraft Engine and Engine Parts Manufacturing	1

ATP IT Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Motor Vehicle Parts Manufacturing	Motor Vehicle Parts Manufacturing	1
Management Consulting Servic	Industrial Mold Manufacturing	1
Soil Preparation, Planting, and Cultivating	Custom Computer Programming Services	1
Optical Instrument and Lens Manufacturing	Optical Instrument and Lens Manufacturing	1
Other Computer Peripheral Equipment Manufacturing	Computer Systems Design Services	1
	Police Protection	1
Aircraft Engine and Engine Parts Manufacturing	Custom Computer Programming Services	2
	Homes for the Elderly	1
Other Aircraft Parts and Auxiliary Equipment Manufacturing	Other Aircraft Parts and Auxiliary Equipment Manufacturing	1
Software Publishers	Iron and Steel Mills	1
	Cutting Tool and Machine Tool Accessory Manufacturing	1
	Motor Vehicle Body Manufacturing	1
	Aircraft Manufacturing	1
	Aircraft Engine and Engine Parts Manufacturing	1
	Surgical and Medical Instrument Manufacturing	1
	Software Publishers	2
Other Sound Recording Industries	Wired Telecommunications Carriers	1
Internet Publishing and Broadcasting	Internet Publishing and Broadcasting	3
Internet Service Providers	Internet Service Providers	1
	Direct Health and Medical Insurance Carriers	1
	Offices of Physicians (except Mental Health Specialists)	1
Custom Computer Programming Services	Commercial and Institutional Building Construction	6
	Ball and Roller Bearing Manufacturing	1
	Other Computer Peripheral Equipment Manufacturing	2
	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	1
	Other Aircraft Parts and Auxiliary Equipment Manufacturing	1
	Game, Toy, and Children's Vehicle Manufacturing	1

ATP IT Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
	Other Airport Operations	1
	Record Production	4
	Internet Publishing and Broadcasting	1
	Cellular and Other Wireless Telecommunications	1
	Internet Service Providers	1
	Web Search Portals	1
	Data Processing, Hosting, and Related Services	2
	Financial Transactions Processing, Reserve, and Clearinghouse Activities	1
	All Other Legal Services	22
	Engineering Services	1
	Industrial Design Services	3
	Custom Computer Programming Services	10
	Computer Systems Design Services	1
	Administrative Management and General Management Consulting Services	1
	Research and Development in the Physical, Engineering, and Life Sciences	1
	Medical Laboratories	4
	Diagnostic Imaging Centers	2
Computer Systems Design Services	Chemical Manufacturing	1
	Machinery Manufacturing	1
	Hospitals	2
	Semiconductor and Other Electronic Component Manufacturing	1
	Industrial Process Furnace and Oven Manufacturing	3
	Cellular and Other Wireless Telecommunications	1
	Data Processing, Hosting, and Related Services	1
	Custom Computer Programming Services	1
	Computer Systems Design Services	4
	Research and Development in the Physical, Engineering, and Life Sciences	1
	All Other Miscellaneous Waste Management Services	2
	Colleges, Universities, and Professional Schools	1
	Professional and Management Development Training	2
	Medical Laboratories	2
	General Medical and Surgical Hospitals	1

ATP IT Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Research and Development in the Physical, Engineering, and Life Sciences	Ambulatory Health Care Services	1
	Repair and Maintenance	1
	Executive, Legislative, and Other General Government Support	1
	Biological Product (except Diagnostic) Manufacturing	1
	Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories Manufacturing	4
	Audio and Video Equipment Manufacturing	1
	Automobile Manufacturing	1
	Motor Vehicle Body Manufacturing	1
	Aircraft Engine and Engine Parts Manufacturing	1
	Scheduled Passenger Air Transportation	1
	Computer Systems Design Services	8
	Other Scientific and Technical Consulting Services	1
	Security Systems Services (except Locksmiths)	1
	Offices of Physicians (except Mental Health Specialists)	1
Security Systems Services (except Locksmiths)	Computer Systems Design Services	1
Colleges, Universities, and Professional Schools	Automobile Manufacturing	1
	Motor Vehicle Body Manufacturing	1
	Computer Systems Design Services	1
	General Medical and Surgical Hospitals	2
Computer Training	Software Reproducing	1
	Game, Toy, and Children's Vehicle Manufacturing	1
	Custom Computer Programming Services	1
	Computer Systems Design Services	1
	Amusement Arcades	1
General Medical and Surgical Hospitals	Computer Systems Design Services	4
Business Associations	Computer Systems Design Services	1
International Affairs	Aircraft Engine and Engine Parts Manufacturing	3

ATP Electronics Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	Computer Terminal Manufacturing	1
Polish and Other Sanitation Good Manufacturing	Semiconductor and Related Device Manufacturing	1
Construction Machinery Manufacturing	Fossil Fuel Electric Power Generation	1
	Aircraft Manufacturing	1
	Pipeline Transportation of Refined Petroleum Products	1
	Engineering Services	2
Semiconductor Machinery Manufacturing	Semiconductor and Related Device Manufacturing	1
Optical Instrument and Lens Manufacturing	Computer Storage Device Manufacturing	1
	Semiconductor and Related Device Manufacturing	1
Photographic and Photocopying Equipment Manufacturing	Semiconductor and Related Device Manufacturing	4
	Cellular and Other Wireless Telecommunications	1
	Research and Development in the Physical, Engineering, and Life Sciences	1
Computer Storage Device Manufacturing	Computer Storage Device Manufacturing	5
Computer Terminal Manufacturing	Other Communications Equipment Manufacturing	1
	Electromedical and Electrotherapeutic Apparatus Manufacturing	1
	Aircraft Manufacturing	1
	Sign Manufacturing	1
	Video Tape and Disc Rental	2
	Research and Development in the Physical, Engineering, and Life Sciences	1
	Amusement Arcades	1
	National Security	2
Other Computer Peripheral Equipment Manufacturing	Photographic and Photocopying Equipment Manufacturing	1
	Other Computer Peripheral Equipment Manufacturing	1
	Semiconductor and Related Device Manufacturing	2
	Irradiation Apparatus Manufacturing	1
	Fiber Optic Cable Manufacturing	3

ATP Electronics Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Telephone Apparatus Manufacturing	Telephone Apparatus Manufacturing	2
	Fire Protection	4
Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	Semiconductor and Related Device Manufacturing	3
	Engineering Services	2
	Fire Protection	2
Other Communications Equipment Manufacturing	Research and Development in the Physical, Engineering, and Life Sciences	2
	General Medical and Surgical Hospitals	2
Audio and Video Equipment Manufacturing	Audio and Video Equipment Manufacturing	1
	Data Processing, Hosting, and Related Services	2
Semiconductor and Related Device Manufacturing	Computer Storage Device Manufacturing	2
	Other Computer Peripheral Equipment Manufacturing	2
	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	1
	Other Communications Equipment Manufacturing	1
	Semiconductor and Related Device Manufacturing	14
	Analytical Laboratory Instrument Manufacturing	1
	Computer Systems Design Services	1
Electronic Coil, Transformer, and Other Inductor Manufacturing	Audio and Video Equipment Manufacturing	1
	Electronic Coil, Transformer, and Other Inductor Manufacturing	1
	Internet Service Providers	2
Electronic Connector Manufacturing	Electronic Connector Manufacturing	1
	Fiber Optic Cable Manufacturing	4
Other Electronic Component Manufacturing	Computer Storage Device Manufacturing	1
	Electronic Connector Manufacturing	2
	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	3
Electromedical and Electrotherapeutic Apparatus Manufacturing	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	1

ATP Electronics Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Analytical Laboratory Instrument Manufacturing	Offices of Physicians, Mental Health Specialists	1
	General Medical and Surgical Hospitals	2
	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	1
	Printed Circuit Assembly (Electronic Assembly) Manufacturing	1
Irradiation Apparatus Manufacturing	Semiconductor and Related Device Manufacturing	2
Magnetic and Optical Recording Media Manufacturing	Software Reproducing	2
Power, Distribution, and Specialty Transformer Manufacturing	Other Communications Equipment Manufacturing	2
Relay and Industrial Control Manufacturing	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	1
	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	1
	Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing	1
Fiber Optic Cable Manufacturing	Other Communications Equipment Manufacturing	5
	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	4
	Fiber Optic Cable Manufacturing	3
	Other Motor Vehicle Electrical and Electronic Equipment Manufacturing	1
	Record Production	1
Current-Carrying Wiring Device Manufacturing	Analytical Laboratory Instrument Manufacturing	1
	Motor and Generator Manufacturing	1
	Motor Vehicle Transmission and Power Train Parts Manufacturing	2
	Motor Vehicle Air-Conditioning Manufacturing	1
	Military Armored Vehicle, Tank, and Tank Component Manufacturing	1
Automobile Manufacturing	Automobile Manufacturing	1
Other Aircraft Parts and Auxiliary Equipment Manufacturing	Semiconductor Machinery Manufacturing	7
	Current-Carrying Wiring Device Manufacturing	2

ATP Electronics Commercialization Portfolio (1999–)
Proposed Commercial Applications by Own-Industry and Use-Industry

NAICS Own-Industry	NAICS Use-Industry	Proposed Commercial Applications
Surgical and Medical Instrument Manufacturing	Colleges, Universities, and Professional Schools	2
Software Publishers	Video Tape and Disc Rental	1
	Offices of Physicians (except Mental Health Specialists)	1
	Ambulance Services	1
Engineering Services	Engineering Services	2
	Industrial Design Services	2
Computer Systems Design Services	Computer Systems Design Services	3
	Offices of Physicians, Mental Health Specialists	1
	Offices of Dentists	1
Other Computer Related Services	Computer Storage Device Manufacturing	1
	Display Advertising	1
Other Scientific and Technical Consulting Services	Computer Terminal Manufacturing	1
	Other Electronic Component Manufacturing	2
	Electromedical and Electrotherapeutic Apparatus Manufacturing	1
	Software Reproducing	1
	Surgical and Medical Instrument Manufacturing	1
Research and Development in the Physical, Engineering, and Life Sciences	Support Activities for Oil and Gas Operations	1
	Plastics Material and Resin Manufacturing	3
	Biological Product (except Diagnostic) Manufacturing	1
	Telephone Apparatus Manufacturing	3
	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	4
	Other Communications Equipment Manufacturing	1
	Semiconductor and Related Device Manufacturing	6
	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	1
	Analytical Laboratory Instrument Manufacturing	2
	Other Lighting Equipment Manufacturing	1
	Fiber Optic Cable Manufacturing	2
	Automobile Manufacturing	1
	Other Sound Recording Industries	1
	Internet Publishing and Broadcasting	1

ATP Electronics Commercialization Portfolio (1999–) Proposed Commercial Applications by Own-Industry and Use-Industry		
NAICS Own-Industry	**NAICS Use-Industry**	**Proposed Commercial Applications**
	Cellular and Other Wireless Telecommunications	1
	Data Processing, Hosting, and Related Services	2
	Research and Development in the Physical, Engineering, and Life Sciences	3
	General Medical and Surgical Hospitals	1
Colleges, Universities, and Professional Schools	Computer Storage Device Manufacturing	2
Grantmaking Foundations	General Medical and Surgical Hospitals	1
Space Research and Technology	Irradiation Apparatus Manufacturing	2

About the Advanced Technology Program

The Advanced Technology Program (ATP) is a partnership between government and private industry to conduct high-risk research to develop enabling technologies that promise significant commercial payoffs and widespread benefits for the economy. ATP provides a mechanism for industry to extend its technological reach and push the envelope beyond what it otherwise would attempt.

Promising future technologies are the domain of ATP:

- Enabling or platform technologies essential to development of future new products, processes, or services across diverse application areas
- Technologies where challenging technical issues stand in the way of success
- Technologies that involve complex "systems" problems requiring a collaborative effort by multiple organizations
- Technologies that will remain undeveloped, or proceed too slowly to be competitive in global markets, in the absence of ATP support

ATP funds technical research, but does not fund product development— that is the responsibility of the company participants. ATP is industry driven, and is grounded in real-world needs. Company participants conceive, propose, co-fund, and execute all of the projects cost-shared by ATP. Most projects also include participation by universities and other nonprofit organizations.

Each project has specific goals, funding allocations, and completion dates established at the outset. All projects are selected in rigorous competitions that use peer review to identify those that score highest on technical and economic criteria. Single-company projects can have duration up to three years; joint venture projects involving two or more companies can have duration up to five years.

Small firms on single-company projects cover at least all indirect costs associated with the project. Large firms on single-company projects cover at least 60 percent of total project costs. Participants in joint venture projects cover at least half of total project costs. Companies of all sizes participate in ATP-funded projects. To date, nearly two out of three ATP project awards have gone to individual small businesses or to joint ventures led by a small business.

Contact ATP for more information:
- On the Internet: www.atp.nist.gov
- By e-mail: atp@nist.gov
- By phone: 1-800-ATP-FUND (1-800-287-3863)
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